Intestinal Parasites of the Pacific

Ethan A. Small BA[*], Alan D. Tice MD[*], Xiaotian Zheng MD, PhD[**,***]

Ethan A. Small BA

Alan D. Tice MD

Authors:
*John A Burns School of Medicine, Honolulu, Hawaii
**Diagnostic Laboratory Services, Inc., Honolulu, Hawaii
***(Present affiliation) Children's Memorial Hospital, Northwestern University, Chicago, Illinois

Correspondence to:
Alan D. Tice, MD
John A Burns School of Medicine
University of Hawaii
University Tower – 7th floor
1356 Lusitana Street
Honolulu, Hawaii 96813
e-mail: alantice@idlinks.com

Abstract

Information about intestinal parasites in Hawaii and the Pacific is not current. We reviewed reports on fecal samples obtained from two laboratories and found recovery rates of 9.3% in Hawaii, 14.2% in Saipan, 18% in Rota and 9.5% in Guam. The most frequently identified parasites were Blastocystis hominis *(7.6%),* Giardia lamblia *(1.2%), and* Entamoeba coli *(0.7%). Although the incidence and types of organisms have changed with time, physicians in Hawaii should continue looking for intestinal parasites.*

Introduction

Intestinal parasites have been a scourge of mankind for millennia. They have adapted to numerous habitats and hosts while spreading throughout the world. Improvements in sanitation and medications, however, have interrupted their life cycles in many instances. Consequently, they have lost their foothold in numerous countries. While the impact of modern medicine has been dramatic in Hawaii, intestinal parasites remain a common cause of disease. Continued immigration of Pacific Island and Asian peoples and travelers bring strongyloides, hookworm, and ascaris while possibly serving as reservoirs for transmission.[1] Parasites may remain asymptomatic for years or may present with symptoms outside the gastrointestinal tract. Some of the most frequently recognized parasites in recent years include *Cryptosporidium parvum* and *Blastocystis hominis*; they remain threats because of their presence in natural reservoirs and public water supplies.[2] The chances of eradicating these organisms are small. Both are thought to be transmitted via a fecal-oral route. *C. parvum* has survived in public water supplies due to its small size (passes through <1um filters) and resistance to chlorination.[3] Controversy exists as to whether *B. hominis* is a pathogenic versus commensual organism. However, outbreaks with symptoms have been reported.[4, 5]

The Center of Disease Control estimated a parasite burden of 20% in the United States during 1987.[6] With advances in sanitation and medication, surveillance and reporting activities were reduced, such that there is little record of the incidence of intestinal parasites or changes that have occurred since. In addition, "new" microorganisms are being recognized that are not visible with standard ova and parasite diagnostic tests. These require special stains and identification techniques in the laboratory.[7]

Reports of intestinal parasites in Hawaii or other Pacific Islands are scarce. Prior publications in 1961 and 1975 indicated 12 and 13% recovery rates.[8, 9] The 1975 study was primarily of school aged children in Oahu with the majority of positive samples occurring in foreign-born subjects.[9] Information about parasitic diseases in other Pacific Islands has been limited to reports of small outbreaks rather than survey results. Old reports do not indicate the distribution of cryptosporidia, microsporidia or blastocystis as they have only recently been identified and reported as pathogens.

Because of the presence of endogenous parasites in Hawaii and the potential for importation from other islands in the Pacific, we set out to gather information from two laboratories in Oahu that perform a large number of tests for ova and parasites from specimens collected in Hawaii as well as other islands.

Methods

MedLINE was searched for information about intestinal parasites. Attempts were made to contact the ministries of health in Hawaii, Australia, New Zealand, Saipan, and Guam plus the London School of Hygiene and Tropical Medicine, the Center for Disease Control, the World Health Organization, and the Swiss Tropical Institute through web pages and e-mail.

Laboratory information was gathered from Diagnostic Laboratory Services (DLS), a commercial laboratory based in Honolulu and from the microbiology department at Tripler Army Medical Center (TAMC). DLS processes samples from all the islands of Hawaii and from Guam, Saipan, and Rota. It was not possible to determine whether samples submitted by Hawaii physicians were taken from patients residing outside of Hawaii. TAMC receives samples from military bases all over the Pacific; however, samples were not identified by geographic source. Both laboratories are certified by the College of American Pathologists for ova and parasite examinations. DLS screens for giardia in all samples, but does does not routinely look for cryptosporidium or cyclospora without a special request. TAMC routinely screens for giardia in all samples, and uses Direct Fluorescence Antibody (DFA) stains to screen for giardia and cryptosporidium in all children under five years old. Identification of blastocystis, hookworm, taenia, and *Entamoeba sp.*

was part of a routine parasitology work up at both laboratories. This included examination of stools with standard concentration and permanent staining methods. Laboratory records for stool samples collected for ova and parasite examinations were accessible from October 1, 2001 until March 1, 2002 through DLS, and November 2001 through February 2002 for TAMC. It was not possible to determine the reason for ordering tests nor the frequency with which fecal ova and parasite examinations were done in any specific population.

Information about specimens was collected without patient identifiers. The study was considered exempt from the Department of Health and Human Services Regulation regarding patient confidentially and informed consent by the Committee of Human Studies at the University of Hawaii.

Results

Findings for specimens reported are displayed in table 1. Results demonstrate a percentage of parasite recovery in all specimens from Saipan (14.2%), Guam (9.5%), Rota (18.5%) and Hawaii (9.3%). The percentage of positive results was 11.0% in DLS samples compared to 7.4% in samples from TAMC. Personal communication revealed that the majority of TAMC samples are from active duty, active reserve, retired military personnel or their families.

The types of parasites identified by the DLS and TAMC labs are also presented in table 1. The parasite recovered most frequently was *B. hominis* found in 60.9% of positive stool samples in Hawaii and 50-77% in other Pacific islands. Giardia was only recovered in 10.7% of positive Hawaii samples and 0-50% in non-Hawaii Pacific Island samples. *Entamoeba histolytica* was found in samples submitted from physicians in Hawaii. Cryptosporidium was not reported in any sample from DLS or TAMC. Ascaris, necator, taenia, trichuris and other helminths were infrequent findings. *Strongyloides stercoralis* was only identified in one sample from Guam and one from Saipan.

Discussion

The system used in this study is not able to determine the true incidence or prevalence of intestinal parasites in the different populations studied. To do so accurately would require large surveys of the peoples of the regions reported which would not be practical. Furthermore, it was not possible to determine whether samples submitted from geographic regions represented follow-up samples from individual patients, thus falsely raising or lowering any calculations of prevalence or incidence. However, the data collected does provide current information about the primary pathogens recovered from various regions in the Pacific, allows for rough comparisons of recent results with old surveys, and demonstrates trends which may appear to be taking place over the last 27 years. Conclusions based on this data are limited in that the criteria for collecting the reported specimens are not clear and undoubtedly vary from one source to another.

There has been an apparent decline in the identification of ova and parasites compared to the older studies of 1974 and 1987.[9, 6] This likely reflects improved sanitation, public health measures, and modern antiparasitic medications. Giardia was reported to be the most frequently identified intestinal parasite in the United States.[10] It was found in 7.2% of all reported stool samples in 1992 with the greatest recovery rate occurring in the Midwest. Desowitz identified giardia in 4.1% of samples taken from Hawaii school aged children in 1974.[9] A recent overall decrease in recovery may be due to greater public awareness of giardia in outdoor waters and travel safety measures. Children ages 0-5 years old, as used in Desowitz's study, demonstrate a higher incidence than other age groups.[10] The prevalence of giardia in the United States may be underrepresented since only 20-50% of patients show signs of illness and patients may not shed cysts in their stool on a daily basis.[11-13] It is unlikely that giardia is underreported in this study as DLS and TAMC routinely screen for the protozoan during standard ova and parasite detection procedures.

The recovery of *Strongyloides stercoralis* in Guam and Saipan reinforces the need to look for parasites in immigrants from these regions. The nematode is found world wide, but primarily in tropical climates. Patients may remain asymptomatic carriers for many years. Serious disease may occur in asymptomatic patients who later become immunocompromised. *Strongyloides* may also cause a variety of extra-intestinal symptoms including cough, pruritis, and weight loss. Hyperinfective strongyloidiasis is often fatal in immunocompromised individuals; frequently leading to acute respiratory distress syndrome and *E. coli* septicemia.[14] It may be beneficial to screen for *Strongyloides* in patients who are HIV positive or about to begin immunosuppressive therapy, particularly if they originate from or traveled to an endemic region.[15]

The discovery of *B. hominis* as the most frequently recovered parasite is of interest. It was reported in only 2.6% of all stool specimens in the 1987 CDC national survey.[10] Desowitz did not report *B. hominis* in 1975, likely due to differences in laboratory staining and reporting requirements. Over the last 25 years, numerous studies have been undertaken to determine whether *B. hominis* is responsible for gastrointestinal disease. Amin recorded *B. hominis* as the most frequently identified parasite (23%) recovered from 2896 patients in the United States during 2000.[16] Doyle reported diarrhea, flatulence, and abdominal pain in a group of 143 patients with *B. hominis* as the only identified organism on studies for bacterial and para-

Table 1.—Percent recovery of parasites from positive stool samples submitted for ova and parasites to Tripler Army Medical Center (TAMC) and Diagnostic Laboratory Services (DLS). Samples from DLS were collected between October 1, 2001 and March 1, 2002. Samples from TAMC were collected between November 27, 2001 and February 27, 2002.

	Stool Samples from TAMC, N=277	Stool Samples from Diagnostic Laboratory Services				
		Hawaii, N=2394	Guam, N=652	Saipan, N=1583	Rota, N=27	Tinian, N=8
Total Number Positive Stool Samples	20	225	67	230	5	2
Parasite						
Blastocystis hominis	8 of 20 (40.0%)	137 of 225 (60.9%)	34 of 67 (50.7%)	178 of 230 (77.4%)	3 of 5 (60.0%)	1 of 2 (50.0%)
Entamoeba coli	2 of 20 (10.0%)	19 of 225 (8.4%)	4 of 67 (6.0%)	8 of 230 (3.5%)	0 of 5 (0.0%)	0 of 2 (0.0%)
Entamoeba histolytica	0 of 20 (0.0%)	13 of 225 (5.8%)	3 of 67 (4.5%)	2 of 230 (0.9%)	0 of 5 (0.0%)	0 of 2 (0.0%)
Hymenolepsis nana	0 of 20 (0.0%)	1 of 225 (0.4%)	0 of 67 (0.0%)	0 of 230 (0.0%)	0 of 5 (0.0%)	0 of 2 (0.0%)
Giardia sp	8 of 20 (40.0%)	24 of 225 (10.7%)	11 of 67 (16.4%)	18 of 230 (7.8%)	0 of 5 (0.0%)	1 of 2 (50.0%)
Ascaris sp.	1 of 20 (5.0%)	2 of 225 (0.9%)	0 of 67 (0.0%)	1 of 230 (0.4%)	1 of 5 (20.0%)	0 of 2 (0.0%)
Hookworm	0 of 20 (0.0%)	6 of 225 (2.7%)	4 of 67 (6.0%)	3 of 230 (1.3%)	1 of 5 (20.0%)	0 of 2 (0.0%)
Strongyloides	0 of 20 (0.0%)	0 of 225 (0.0%)	1 of 67 (1.5%)	1 of 230 (0.4%)	0 of 5 (0.0%)	0 of 2 (0.0%)
Trichuris trichiura	1 of 20 (5.0%)	1 of 225 (0.4%)	1 of 67 (1.5%)	2 of 230 (0.9%)	0 of 5 (0.0%)	0 of 2 (0.0%)
Taenia sp.	0 of 20 (0.0%)	7 of 225 (3.1%)	0 of 67 (0.0%)	0 of 230 (0.0%)	0 of 5 (0.0%)	0 of 2 (0.0%)

sitic pathogens.[17] Other studies maintain a commensual role for the protozoan.[5, 17] The increased recovery of *B. hominis* shown in our study is in part due to improved laboratory methodology. DLS also began routinely reporting *B. hominis* in 1998. However, it is also possible that the organism is becoming more frequent in Hawaii as a result of contamination of public water supplies and waning standards for water purification.

There was a low recovery rate for *E. histolytica* in Hawaii. Comparisons with prior national studies are limited by the study methods. Differences in immigrant populations and the protozoans they often carry also prevent us from making conclusions about recent national and local trends.

Cryptosporidium was not reported in our data sets even though there was a 0.2% recovery rate from stool samples submitted to diagnostic laboratories in the 1987 national survey.[10] Cryptosporidium has received more attention as a cause of chronic, profuse watery diarrhea in immunocompromised populations. The organism has also been the cause of several large waterborne outbreaks of gastroenteritis.[7, 3] It has a low infectious dose, is capable of passing through many water purification filters, and is resistant to chlorination treatments.[19, 6] Detection for cryptosporidium is also still suboptimal in many laboratories. Currently, DLS does not routinely screen for cryptosporidium, cyclospora, or microsporidia. Special requests must be made in order to identify these organisms in submitted stool samples. TAMC routinely screens for crytosporidium only in children under 5 years old.

The discrepancy between the recovery rates in TAMC and DLS samples are best explained by the different populations the laboratories service. Samples submitted to TAMC are primarily from military and retired military with dependents who reside in Hawaii. In contrast, the samples from DLS are likely from native residents or from immigrants from other islands in the Pacific.

We are unable to compare the recovery rates of intestinal parasites between Hawaii and non-Hawaii Pacific Islands. However, limited resources in sanitation and medication, as well as the natural presence of these pathogens in developing nations give these regions a relatively high prevalence of intestinal parasites.

Intestinal parasites continue to be a challenge to clinicians in Hawaii. Although the classic pathogens are recovered less frequently, they may continue to be imported by recent or past immigrants. The situation is further complicated by the ability of some parasites to produce no intestinal symptoms and to mimic other diseases for which parasites are not suspected. Patients with acute or chronic intestinal symptoms should be studied for parasite infections as part of a complete work-up. Patients without symptoms who spent significant time in Pacific Islands other than Hawaii also benefit from ova and parasite screening.

Acknowledgments

We gratefully acknowledge the assistance of Mr. Bardwell J. Eberly, Department of Pathology & ALS at Tripler Army Medical Center for his contributions in providing data for this article.

References

1. Kramer, K., et. al. "Parasitic Infestations in Southeast Asian Refugees." *Hawaii Med J.* 1984, 43: 12-16.
2. Garcia, Lynne. *Diagnostic Medical Parasitology.* 4th ed. Washington, D.C.: ASM Press; 2001: 714-6.
3. Hayes, EB, et. al. "Large community outbreak of Cryptosporidiasis due to contamination of a filtered public water supply." *N Engl J Med.* 1989, 320: 1372-6.
4. Dagci, H., et. al. "Protozoon infections and intestinal permeability." *Acta Tropica.* 2002, 81: 1-5.
5. Miller, R. and Minshew, B. "*Blastocystis hominis*: An Organism in Search of a Disease." *Rev Infectious Dis.* 1988, 10: 930-7.
6. Kappus, K., et. al. "Intestinal Parasitism in the United States: Update on a Continuing Problem." *Am J Trop Med Hyg.* 1994, 50: 705-713.
7. Mac Kenzie, WR et al. "A massive outbreak in Milwaukee of Cryptosporidium infection transmitted through the public water supply." *N Engl J Med.* 1994, 331: 161-7.
8. Ching, HL. "Internal parasites of man in Hawaii with special reference to Heterophyid flukes." *Hawaii Med J.* 1961, 20: 442.
9. Desowitz, R. and Wiebenga, N. "A Survey for Intestinal Parasites in Oahu Schoolchildren." *Hawaii Med J.* 1975, 34: 21-23.
10. Furness, BW. "Giardiasis surveillance – United States, 1992-1997." *Mor Mortal Wkly Rep CDC Surveillance Summary.* 2000, 49: 1-13.
11. Killion, L et al. "Clinical Giardiasis on Maui." *Hawaii Med J.* 1981, 40:178-9.
12. Garcia, L, et. al. "Evaluation of Nine Immunoassay Kits (Enzyme Immunoassay and Direct Fluorescence) for Detection of *Giardia lamblia* and *Cryptosporidium parvum* in Human Fecal Specimens." *J Clin Micro.* 1997: 1526-1529.
13. Garcia, L, et. al. "Detection of *Giardia lamblia, Entamoeba histolytica/Entamoeba dispar*, and *Crptosporidium parvum* Antigens in Human Fecal Specimens Using the Triage Parasite Panel Enzyme Immunoassay." *J Clin Micro.* 2000: 3337-3340.
14. Adedayo, O., et. al. "Hyperinfective Strongyloidiasis in the Medical Ward: Review of 27 Cases in 5 Years." *South Med J.* 2002, 95: 711-716.
15. Palmer, P. *The Imaging of Tropical Diseases.* 2nd ed. Heidelberg, Germany and New York: Springer; 2001: 67-88.
16. Amin, O. "Seasonal Prevalence of Intestinal Parasites in the United States During 2000." *Am J Trop Med Hyg.* 66: 799-803.
17. Doyle, P., et. al. "Epidemiology and Pathogenicity of *Blastocystis hominis.*" *J Clin Micro.* 1990, 28: 116-21.
18. Markell, EK and Udkow, MP. "*Blastocystis hominis*: pathogen or fellow traveler?" *Am J Trop Med Hyg.* 1986, 35: 1023-6.
19. Katz, DE and Taylor, D. "Parasitic Infections of the Gastrointestinal Tract." *Gastroenterol Clin North Am.* 2001, 30: 797-815.